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File: USPT

Nov 11, 2003

DOCUMENT-IDENTIFIER: US 6644272 B2

TITLE: Diesel engine

Abstract Text (1):

A diesel engine (1) has: a flow adjuster (10) for throttling exhaust flow; an intake heater (71) for heating intake air; a thermal medium circulator (72) for circulating a thermal medium to warm the diesel engine (1); a cylinder cut-off device (73) for conducting cylinder cut-off; and a fuel injection timing advancing device (74) for advancing timing for supplying fuel to a cylinder, the respective devices being actuated at least from pre-high-idle step to a neighborhood of high-idle condition, so that fuel combustion stabilization of the diesel engine (1) can be rapidly enhanced during a period where less fuel is supplied into the cylinder and fuel combustion time is short, thus greatly reducing discharge of white smoke and possibility of engine bunching.

Brief Summary Text (6):

Specifically, when intake flow is throttled by the flow adjuster, the intake air supplied from the outside into the cylinder of the diesel engine and the exhaust discharged from the cylinder is decreased, less heat quantity is lost by the intake-air of which temperature is low as compared to the temperature in the cylinder, and more heat quantity can be given in the cylinder by the exhaust, so that the in-cylinder temperature can be easily raised, thereby accelerating ignition and complete combustion of the fuel.

Brief Summary Text (7):

On the other hand, when the exhaust flow is throttled by the flow adjuster, more high-temperature exhaust can be retained in the cylinder without being discharged and the intake air supplied into the cylinder can be decreased as in throttling the intake air, the inside of the cylinder can be warmed by the temperature of the exhaust and less heat quantity is lost by the intake air, so that in-cylinder temperature can be easily raised and ignition and complete combustion of the fuel can be enhanced.

Detailed Description Text (36):

In other words, the flow adjuster 10 works as a combustion stabilization assist for enhancing stabilization of combustion of the fuel supplied in the cylinder.

Detailed Description Text (78):

FIG. 6 shows a third embodiment of the present invention. In the third embodiment, though the ignition and complete combustion of the fuel is enhanced by the single flow adjuster 10 as the combustion stabilization assist in the above-described first embodiment, the ignition and complete combustion of the fuel is enhanced by the five combustion stabilization assist including the flow adjuster 10.

Detailed Description Text (79):

Specifically, the diesel engine 1 has five combustion stabilization assist of an intake heating device 71 for heating intake air, a thermal medium circulator 72 for warming the diesel engine 1 by circulating thermal medium, a cylinder cut-off

device 73 for conducting cylinder cut-off operation and a fuel injection timing advancing device 74, for advancing the timing for supplying fuel to the cylinder as well as the flow adjuster 10 for throttling the flow of the exhaust.

Detailed Description Text (82):

Further, though not shown, a fuel injection pump for compressively feeding the fuel to the cylinder is provided to each bank in the present embodiment, the two fuel injection pumps being provided with an electric governor 1B respectively for adjusting fuel injection amount and fuel injection timing of the pump. The two electric governors 1B are electrically connected to the engine controller 60 and the operation thereof is controlled by a control signal outputted by the engine controller 60.

Detailed Description Text (138):

Incidentally, since the operation of the flow adjuster 10 is the same as in the above-described first embodiment, description thereof is simplified here. Specifically, as shown in FIG. 9, when the start (ON) signal from the starting switch is inputted, the flow adjuster 10 shuts the butterfly valve 11 to throttle the exhaust flow. Subsequently, when the fuel injection quantity F reaches the predetermined fuel injection quantity F0, i.e. when the load is started to be applied, the butterfly valve 11 is opened to release throttle of the exhaust flow. In other words, the flow adjuster 10 throttles the exhaust flow during the period from the start of the starting mode M2 in starting the engine to the halfway of the high-idle mode M7 (first predetermined period) to enhance combustion stabilization of the fuel in the diesel engine 1.

Detailed Description Text (186):

Since the five combustion stabilization assist 10, 71, 72, 73 and 74, i.e. the flow adjuster 10, the intake heating device 71, the thermal medium circulator 72, the cylinder cut-off device 73 and the fuel injection timing advancing device 74 are used in the present embodiment, stabilization of fuel combustion in the diesel engine 1 can be rapidly enhanced, so that the possibility of white smoke discharge and engine hunching can be greatly reduced.

Detailed Description Text (194):

FIG. 15 shows fourth embodiment of the present invention. Though the open timing of the butterfly valve 11 of the flow adjuster 10 is set in accordance with the fuel supply into the cylinder in the above-described third embodiment, the open operation is set based on the operation mode signal from the operation mode setting means 61 in the present fourth embodiment.

Detailed Description Text (195):

Specifically, in the present embodiment, the engine controller 60 determines whether the exhaust flow is throttled by the butterfly valve 11 or not in accordance with the operating condition of the diesel engine 1 and a flow adjustment controller 101 installed in the engine controller 60 is provided to the flow adjuster 10 instead of the solenoid valve controller. Incidentally, though not described in detail, the operation mode setting means 61, the intake heating control section 713, the thermal medium circulation controller 727, the cylinder cut-off control section 731 and the fuel supply timing advance timing controller 741 are installed in the engine controller 60 as well as the flow adjustment controller 101 as in the above-described third embodiment.

Detailed Description Text (211):

Since the flow adjuster 10 is actuated until more than predetermined load is applied in the high-idle mode M7, i.e. until the operation mode is transferred to the rated power mode M8, the diesel engine 1 can be warmed by the flow adjuster until the diesel engine 1 is substantially warmed by increasing the amount of fuel supplied into the cylinder. Accordingly, since the diesel engine 1 is sufficiently warmed, the ignition and complete combustion of the fuel can be sufficiently

enhanced, thus preventing generation of engine hunching and discharge of white smoke.

Detailed Description Text (221):

The flow adjuster 10, the intake heating device 71, and the thermal medium circulator 72 may be actuated in any periods out of the first to the ninth predetermined periods, and the cylinder cut-off device 73 and the fuel injection timing advancing device 74 may be driven in any periods out of the first to the sixth predetermined periods.

Detailed Description Text (226):

The diesel engine is not restricted to include the five combustion stabilization assist of flow adjuster 10, the intake heating device 71, the thermal medium circulator 72, the cylinder cut-off device 73 and the fuel injection timing advancing device 74, but may be an engine having at least one of the combustion stabilization assist.

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